

REMARKS

Claims 1 to 25 have been examined. Non-elected claims 26 to 31 have been canceled. Claims 1 to 25 have been amended to correct informalities and to place them in US claiming style. Claims 32 to 34 have been added based on existing, pending claims and the disclosure in the present specification. No new matter has been added.

Claim Rejections – 35 USC §112

Claims 3 to 25 have been rejected as being indefinite. The claims have been amended to correct their informalities and to conform to US claim drafting style. Each of the indefinite issues have been addressed. No new matter has been added. Withdrawal of this rejection is respectfully requested.

Claim Rejections – 35 USC §103(a)

Claims 1 and 2 have been rejected as being unpatentable over Lee. Applicants submit that the claims are not obvious over the cited prior art for the following reasons.

Claim 1 as amended recites:

1. (Amended) A heat radiating device comprising:
a heat radiating substrate containing Al as a major component; and
a metal film containing Cu, Ag, Sn, Ni, or Au disposed on the heat radiating substrate.

The patent to Lee does not teach or suggest any heat sink containing aluminum as a major component. Lee's Figs. 3, 7, 8, 11 and 12 teach using a heat sink made of Cu. Furthermore, a description on Lee's Figs. 1 states: "A heat sink 25 is mounted on the back surface 12 of chip 10, typically by forming a gold-silicon eutectic bond 26 between the heat sink 25 and the chip 10." Nowhere in the patent to Lee is there a description that the heat sink 25 is made of aluminum.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA

1974). The prior art does not teach or suggest the present feature of claim 1 as indicated above. Indeed, the other parts of the patent suggest using Cu, not Al for the heat sink.

Further, because the prior art suggests using a Cu heat sink and attaching a solder to this heat sink (see, for example, Fig. 7), a person of ordinary skill in the art would not have been taught, suggested, or motivated to use Al as a major component for the heat sink. Moreover, a skilled person would not have been motivated to use Al because it is known in the art that adhering a brazing solder on aluminum would be difficult (see page 22, lines 10 to 18 of the present specification).

It is further pointed that there are advantageous effects of the present invention not appreciated by the prior art. An oxide film formed on Lee's copper heat sink would not be stable. When a heat sink made of Cu is exposed to a highly humid environment, fine oxide is scattered. The scattered oxide adversely affects electronic devices provided around the heat sink. In contrast, an oxide film formed on a heat radiating substrate containing Al is dense, and therefore, oxide is not scattered to adversely affect the surrounding devices. Also, the use of Al instead of Cu would further reduce the weight of the device.

Thus, a person of ordinary skill in the art would not have found the invention of claim 1 obvious over the cited prior art for the foregoing reasons.

Similarly, other independent claims 5, 14, and 21 all share the common features as claim 1, and therefore, they are unobvious at least for the same reasons as claim 1. Moreover, all dependent claims (claims 2 to 4, claims 6 to 13, and claims 22 to 25) to claims 1, 5, 14, and 21 are unobvious at least for the same reasons as their independent claims.

New Claims

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Claim 32 having similar features as claim 1 is also unobvious at least for the same reason as claim 1. Claims 33 and 34 depend on claim 32 and thus at least for the same reason as claim 32, these also are unobvious.

Summary

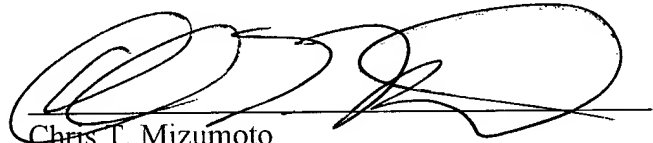
Thus, for the foregoing reasons, Applicants request that all of the pending claims be allowed.

Attached is a marked-up version of the changes being made by the current amendment.

Applicant asks that all claims be allowed. Enclosed is check for the Petition for Extension of Time fee (one-month). Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 1/3/03


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Version with markings to show changes made

In the claims:

Claims 26 to 31 have been cancelled.

Claims 1 to 6, 11 to 23, and 25 have been amended as follows (unamended claims are shown in bold, small type-face for ease of reference only):

1. (Amended) A heat radiating device comprising: [A radiation]
a heat radiating substrate [having a first surface and a second surface, both
opposed to each other, and] containing Al as a major component; and [,]
[wherein] a [first] metal film containing Cu, Ag, Sn, Ni, or Au [as major material is
formed] disposed on the heat radiating substrate [as an uppermost layer on the first surface].

2. (Amended) [A radiation substrate] A heat radiating device according to claim 1,
wherein the [first] metal film consists of a plating film.

3. (Amended) [A radiation substrate] A heat radiating device according to claim
[2] 1, wherein the metal film is configured to contact a metal body provided on a back
surface of a semiconductor device [is adhered by brazing solder, conductive paste, or
adhering material having excellent thermal conductivity].

4. (Amended) [A radiation substrate] A heat radiating device according to claim
[3] 1, wherein [the semiconductor device is mounted to be connected electrically to an
electronic equipment, and the second] a surface of the heat radiating substrate opposite to
the surface over which the metal film is disposed is coupled to an external device [is
worked such that it can be connected to a constituent element made of metal in the
electronic equipment via surface contact].

5. (Amended) A semiconductor module comprising:

a semiconductor device [in which a face up] including a semiconductor element, [is sealed integrally by insulating resin and also] pads [connected] coupled electrically to bonding electrodes of the semiconductor element, and an island [positioned] disposed on a back surface of the semiconductor element, [are exposed from the back surface] said semiconductor device integrally sealed with resin except where the island and the pads are disposed; and

a [radiation] heat radiating substrate [having a first surface and a second surface, both opposed to each other, and] containing Al as a major component; and

[wherein] a first metal film containing Cu, Ag, Sn, Ni, or Au and disposed on the heat radiating substrate, [as major material and formed by plating is formed as an uppermost layer on the first surface, and]

wherein the first metal film and the island are [adhered together] coupled by brazing solder, conductive paste, or adhering material having [excellent] thermal conductivity.

6. (Amended) A semiconductor module according to claim 5, wherein a second metal film containing Cu as a major component is [adhered] disposed between the first metal film and the island.

7. A semiconductor module according to claim 6, wherein the island and the metal plate are formed integrally by the etching process.

8. A semiconductor module according to claim 5, wherein a back surface of the semiconductor element is adhered to the metal plate.

9. A semiconductor module according to claim 5, wherein back surfaces of the pads and a back surface of the island are arranged substantially on a same planar surface.

10. A semiconductor module according to claim 8, wherein back surfaces of the pads and a back surface of the semiconductor element are arranged substantially on a same planar surface.

11. (Amended) A semiconductor module according to claim 9 or claim 10, wherein a back surface of the insulating resin [is projected rather than] projects beyond back surfaces of the pads.

12. (Amended) A semiconductor module according to claim 11, wherein side surfaces of the pads and [a] the back surface of the insulating resin [extended] extending from the side surfaces of the pads draw a same curved surface.

✓ 13. (Amended) A semiconductor module according to claim 12, further comprising: [wherein] a flexible sheet having conductive patterns [connected] coupled electrically to the semiconductor device, said sheet [is] provided between the semiconductor device and the radiation substrate; [,] and
an opening [portion is] provided in the flexible sheet to [respond] correspond to the island.

14. (Amended) A semiconductor module comprising:

a semiconductor device [in which a face down] including a semiconductor element, [is sealed integrally by insulating resin and also] pads [connected] coupled electrically to bonding electrodes of the semiconductor element, and a [radiation] radiating electrode [positioned] disposed on a back surface of the semiconductor element, [are exposed from the back surface] said semiconductor element integrally sealed with resin except where the radiating electrode and the pads are disposed; [and]

a [radiation] heat radiating substrate [having a first surface and a second surface, both opposed to each other, and] containing Al as a major component; and

[wherein] a first metal film containing Cu, Ag, Sn, Ni, or Au disposed on the heat radiating substrate, [as major material and formed by plating is formed as an uppermost layer on the first surface, and]

wherein the first metal film and the [radiation] radiating electrode are [adhered together] coupled by brazing solder, conductive paste, or adhering material having [excellent] thermal conductivity.

✓ 15. (Amended) A semiconductor module according to claim 14, [wherein] further comprising:

a second metal film containing Cu as a major component [is adhered] and disposed between the first metal film and the [radiation] radiating electrode.

16. (Amended) A semiconductor module according to claim 14, wherein the [radiation] radiating electrode and the metal plate are formed integrally by [the] etching [process].

17. (Amended) A semiconductor module according to claim 14, wherein back surfaces of the pads and [a] the back surface of the radiation electrode are arranged substantially on a same planar surface.

18. (Amended) A semiconductor module according to claim 17, wherein a back surface of the insulating resin [is projected rather than] projects beyond the back surfaces of the pads.

19. (Amended) A semiconductor module according to claim 18, wherein side surfaces of the pads and [a] the back surface of the insulating resin [extended] extending from the side surfaces of the pads draw a same curved surface.

✓ 20. (Amended) A semiconductor module according to claim 19, [wherein] further comprising:

a flexible sheet having conductive patterns [connected] coupled electrically to the semiconductor device, said flexible sheet [is] provided between the semiconductor device and the [radiation] heat radiating substrate; [,] and

an opening [portion is] provided in the flexible sheet to [respond] correspond to the [radiation] radiating electrode.

21. (Amended) A semiconductor module comprising:

a semiconductor device [in which a face up] including a semiconductor element, [is sealed integrally by insulating resin and also] leads [connected] coupled electrically to bonding electrodes of the semiconductor element, and an island whose back surface is [positioned] disposed on a same surface level as a back surface of the leads, [are exposed from the back surface] ; and

a [radiation] heat radiating substrate [having a first surface and a second surface, both opposed to each other, and] containing Al as a major component; and

[wherein] a first metal film containing Cu, Ag, Sn, Ni, or Au disposed on the heat radiating substrate, [as major material and formed by plating is formed as an uppermost layer on the first surface, and]

wherein the first metal film and the island are [adhered together] coupled by brazing solder, conductive paste, or adhering material having [excellent] thermal conductivity.

✓ 22. (Amended) A semiconductor module according to claim 21, [wherein] further comprising:

a second metal film containing Cu as a major component, said second metal film disposed [is adhered] between the first metal film and the island.

↙ 23. (Amended) A semiconductor module according to claim 22, [wherein] further comprising:

a flexible sheet having conductive patterns [connected] coupled electrically to the semiconductor device, said flexible sheet [is] provided between the semiconductor device and the [radiation] heat radiating substrate, and

an opening [portion is] provided in the flexible sheet to [respond] correspond to the island.

24. A semiconductor module according to claim 13, claim 20 or claim 23, wherein the semiconductor device is a read/write amplifier IC for a hard disk.

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25. (Amended) A semiconductor module according to claim 13, claim 20 or claim 23, wherein the semiconductor device [is mounted to be connected] couples electrically to an [electronic equipment] external device through the heat radiating substrate [, and the second surface is worked such that it can be connected to a constituent element made of metal in the electronic equipment via surface contact].